Unit -3 Mathematical Logic & Boolean Algebra

118	Define logical connectives; give examples of at least two.	02	D15
119	Define value of Boolean Expression with example	02	D15
120	Show that D_{12} is a Boolean Algebra where $\forall a, b \in D_{12}$ $a + b = LCM\ of\ a, b$ $a \cdot b = GCD\ of\ a, b$ $a' = {}^{12}/_{a}$	05	D15
121	Prove that the argument in the following example is not logically valid (3 times) Hypothesis: $S_1: p \wedge (\sim q) \rightarrow r$ Conclusion: $S: r$ $S_2: p\ v\ q$ $S_3: q \rightarrow$ p	05	D15
122	Using truth table, prove that i) $(p \rightarrow q) = [(\sim q) \rightarrow (\sim$p)] ii) $\sim(p \rightarrow$ q) = p^($\sim$q)	05	D15
123	Construct input/output table for i) $f(x) = (x_1, x_2, x_3) = (x_1 \cdot x_2)' + x_3$ ii) $f(x) = (x_1, x_2) = (x_1 \cdot x_2) + x_2$	05	D15
124	In a Boolean Algebra B, prove that $x + 1 = 1$ and $x \cdot 0 = 0; \forall x \in B$	05	D15
125	Find the product sum canonical form of $f(x_1, x_2) = x_1 \cdot x_2 + x_1' \cdot x_2 + x_1 \cdot x_2'$	05	D15
126	Show that D_{21} is a Boolean Algebra where $\forall a, b \in D_{21}$(4 times) $a + b = LCM\ of\ a, b$ $a \cdot b = GCD\ of\ a, b$ $a' = {}^{21}/_{a}$	05	D15
127	Define Duality in Boolean Algebra (2 times)	02	M15
128	Define critical raw	02	M15
129	Show that D_{15} is a Boolean Algebra where $\forall a, b \in D_{15}$ $a + b = LCM\ of\ a, b$ $a \cdot b = GCD\ of\ a, b$ $a' = {}^{15}/_{a}$	05	M15
130	Let $B = \{0,1\}$. Prepare an input/output table for the Boolean function $f: B^2 \rightarrow B$, $f(x) = x_1 \cdot x_2'$	05	M15
131	Using truth table, prove that $(p \rightarrow q)$^[$p \rightarrow$ r] = p → (q^r) (3 times)	05	M15
132	Construct input/output table for (2 times) i) $f(x) = (x_1, x_2, x_3) = (x_1 \cdot x_2)' + x_3$ ii) $f(x) = (x_1, x_2) = x_1' \cdot x_2$	05	M15
133	Using truth table, prove that $p \wedge (q\ v\ r) = (p \wedge q)\ v\ (p \wedge r)$ (2 times)	05	M15
134	Show that D_9 is a Boolean Algebra where $\forall a, b \in D_9$ (3 times) $a + b = LCM\ of\ a, b$ $a \cdot b = GCD\ of\ a, b$ $a' = {}^{9}/_{a}$	05	M15

135	Define Boolean Algebra (4 times)	02	D14
136	Check the validity of the following argument Hypothesis: $S_1: p \to (\sim q)$ Conclusion: $S: (\sim p)$ $S_2: r \to q$ $S_3: r$	05	D14
137	prove the validity of the following argument (2 times) Hypothesis: $S_1: p \to q$ Conclusion: $S_1: p \to r$ $S_2: q \to r$	05	D14
138	Show that D_8 is a not Boolean Algebra where $\forall a, b \in D_8$ (3 times) $a + b = LCM\ of\ a, b$ $a \cdot b = GCD\ of\ a, b$ $a' = {}^{8}/_{a}$ OR Let $D_8 = \{1,2,4,8\}$. Define $+$, $\cdot$ and $'$ on D_8 by $x + y = LCM\ of\ x, y$ $x \cdot y = GCD\ of\ x, y$ $x' = {}^{8}/_{x}$. Verify that $(D_8, +, \cdot, ', 1, 8)$ is not Boolean Algebra	05	D14
139	Construct truth table for $p \to q$ and $p \leftrightarrow q$	01	M14
140	Define Tautology and Contradiction	01	M14
141	Show that D_{10}(Divisor of 10) is a Boolean Algebra where $\forall a, b \in D_{10}$ (3 times) $a + b = LCM\ of\ a, b$ $a \cdot b = GCD\ of\ a, b$ $a' = {}^{10}/_{a}$	05	M14
142	Using truth table, prove that $(p\ v\ q) \to r = (p \to r)$ ^ $(q \to r)$	05	M14
143	In a Boolean Algebra, show that $(XY'Z' + XY'Z + XYZ + XYZ')(X + Y) = X$	05	M14
144	Simplify Boolean Expression using Boolean Algebra (X+Y+XY)(X+Y)	05	M14
145	Prove that p^$(p\ v\ q) = p$ and $p\ v(p$^$q) = p$ (2 times)	02	D13
146	Prove the following using truth table: (3 times) i) p^$(q$^$r) = (p$^$q)$^r ii) p^$(q\ v\ r) = (p$^$q)v(p$^$r)$	05	D13
147	Construct input/output table for i) $f(x_1, x_2, x_3) = (x_1 \cdot x_2') \cdot x_3$ (3 times) ii) $f(x_1, x_2) = x_1 \cdot x_2$ (2 times)	05	D13
148	In a Boolean Algebra show that $0' = 1$ and $1' = 0$	02	M13
149	Define principle of Duality in Boolean Algebra	02	M13
150	$\forall x, y \in B$ where B is a Boolean Algebra, prove that $(x \cdot y)' = x' + y'$ and $(x + y)' = x' \cdot y'$ (2 times)	05	M13
151	In a Boolean Algebra, prove that the compliment of any element is unique.	05	M13
152	Find the product sum canonical form of $f(x_1, x_2) = x_1' \cdot x_2 + x_1' \cdot x_2' + x_1 \cdot x_2'$ (3 times)	05	M13
153	Prove the following laws: (2 times)	05	M13

	i) $\sim(p \ v \ q) = (\sim p)^\wedge(\sim q)$		
	ii) $\sim(p \ ^\wedge q) = (\sim p)v(\sim q)$		
154	Define Boolean Expression	02	D12
155	For any element x, y of a Boolean algebra, prove that $x \cdot y' = 0 \leftrightarrow x \cdot y = x$	05	D12
156	Define contradiction	02	M12
157	Find the value of $((x_1 \cdot x_2') + x_3) \cdot x_2{}'$ if i) $x_1 = 0, x_2 = 1, x_3 = 1$ ii) $x_1 = 0, x_2 = 0, x_3 = 1$	05	M12
158	Simplify the Boolean expression $x + x' \cdot (x + y) + y \cdot z$	05	M12
159	If t is tautology and p is a statement then prove that $p \ v \ t = t$	01	D11
160	In a Boolean Algebra, prove that $x + x = x$	01	D11
161	In a Boolean Algebra, prove that $x + (x \cdot y) = x$ and $x \cdot (x + y) = x$	05	D11
162	Prepare truth table for the following statements: i) $(p \ v \ q)v \ r$ ii) $(\sim p)vq$	05	D11
163	Explain idempotent law in Boolean Algebra	01	M11
164	Give truth table of $(p \rightarrow q)$ and $(p \leftrightarrow q)$	01	M11
165	Is the argument in the following example valid? Hypothesis: $S_1: p \rightarrow q$ Conclusion: $S: p \rightarrow r$ $S_2: q \rightarrow$ r (Use truth table)	05	M11
166	Is the argument in the following example valid? Hypothesis: $S_1: p$ Conclusion: $S: r$ $S_2: (p \ ^\wedge q) \rightarrow (r \ v \ s)$ $S_3: q$ $S_4: \sim s$	05	M11

Remarks:-